

Remote Sensing of Tropospheric Ozone
with the Tropospheric Emission Spectrometer

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The Tropospheric Emission Spectrometer (TES) is an imaging infrared Fourier transform spectrometer scheduled to be launched into polar sun-synchronous orbit on the Earth Observing System (EOS) CHEM satellite in December 2002.

The primary objective of TES is to map the global 3-dimensional distribution of tropospheric ozone (O₃) and the chemical species involved in its formation and destruction. This is a very ambitious objective because a) only about 10% of the total ozone in the Earth's atmosphere is in the troposphere - most is in the stratosphere through which, of course, any spaceborne system must observe, and b) many of the critical reactive species exist only at very low concentrations. It therefore requires a very carefully designed, high performance, instrument to make the necessary measurements. In particular, such low concentrations can generally only be measured by the technique of limb sounding, which increases the path length some 100-fold at the expense of poorer spatial resolution along the line of sight.

On the other hand, the major species such as ozone itself, water vapor, carbon monoxide and methane are readily measured by nadir viewing (with better localization but relatively limited vertical resolution), so an initial requirement on TES is that it must provide both limb and nadir sounding capability.

The environmental impacts of tropospheric ozone are very different from stratospheric O₃. First, near-surface tropospheric O₃ is a primary air pollutant. In the free troposphere, O₃ is the major source of OH, the principal cleansing agent of the atmosphere. In the upper troposphere, O₃ is an efficient greenhouse gas. Thus it is very important to map the global 3-dimensional distribution of tropospheric ozone and its associated chemical species in order to improve our understanding of the factors controlling ozone in different regions of the atmosphere.

The talk will focus on how these scientific goals flow down into the instrument design and profile retrieval requirements.